

REMARKS

Objection to Drawings

The drawings have been objected to because they do not show pin one indicators as claimed in claims 266 and 267. In response to this objection, claims 266 and 267 have been amended to remove this limitation.

Grounds of Rejections

Claims 170, 171, 174-177, 262-264, 268 and 270 have been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245) and Farnworth et al. (US Patent No. 6,620,731).

Claims 172, 173 and 264 have been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and Farnworth et al. (US Patent No. 6,097,087).

Claim 178 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and Akram (US Patent No. 6,544,821).

Claim 179 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and Gilleo et al. (US Patent No. 6,228,678).

Claims 266 and 267 have been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and Hembree et al. (US Patent No. 6,313,651).

Claim 269 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in

view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and Lin (US Patent No. 5,436,203).

Claim 271 has been rejected under 35 USC 103(a) as being obvious over Wakabayashi (US Patent No. 6,607,970) in view of Kinsman et al. (US Patent No. 6,717,245), Farnworth et al. (US Patent No. 6,620,731) and "Functional Smart Materials" by Wang.

The rejections under 35 USC §103, are traversed for the reasons to follow.

Summary Of Claimed Subject Matter

Claims 170-179 and 262-271 are directed to a semiconductor component 16 (Figures 4A-4C and 1K) which includes a thinned semiconductor die 10T (Figure 4C) having a circuit side 20 (Figure 4C), a thinned back side 22T (Figure 4C), and a plurality of peripheral edges 30 (Figure 4C). The component 16 (Figures 4A-4C) also includes a first polymer layer (circuit side polymer layer 36P (Figure 4C) and edge polymer layers 40 (Figure 4C) covering the circuit side 20 and the edges 30. The component 16 (Figures 4A-4C) also includes a second polymer layer (back side polymer layer 38P (Figure 4C)) covering the back side 22T.

The component 16 (Figures 4A-4C) also includes a plurality of die contacts 18 (Figure 4C) on the die 10T, and a plurality of contact bumps 24P (Figure 4B) on the die contacts 18 embedded in the first polymer layer 36P (Figure 4C). The component 16 (Figures 4A-4C) also includes terminal contacts 42 (Figure 4C) on the contact bumps 24P.

As shown in Figure 8F, the component can also include conductive vias 70A (Figure 8F) in electrical communication with the die contacts 18, and terminal contacts 42A (Figure 8F) on the conductive vias 70A.

35 USC §103(a) Rejections Of Claims 170, 171, 174-177, 262-264, 268 and 270 Over Wakabayashi, Kinsman et al. and Farnworth et al. ('731)

Wakabayashi was cited as disclosing a semiconductor component comprising a semiconductor die (1-Figure 10), a plurality of contact bumps (electrodes 6-Figure 10), a first polymer layer (seal film 13-Figure 15) covering the circuit side and edges of the die, and a second polymer layer (seal film 17-Figure 15) covering the back side of the die.

Kinsman et al. was cited as disclosing contact bumps (conductive elements 20) and terminal contacts (external conductive elements 32) on the contacts bumps.

Farnworth et al. ('731) was cited as disclosing a thinned die (column 8, lines 61-67) with conductive vias (conductive member 34).

1. No Incentive To Combine References

The rejections under 35 USC §103(a) are traversed because one skilled in the art at the time of the invention would have no incentive to combine the references in the manner of the Office Action. As a proposed incentive for combining the thinned die of Farnworth et al. ('731) with Wakabayashi the Office Action states "It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Wakabayashi to include a thinned die in Farnworth because it aids in exposing conductive members (For Example: See Column 8 Lines 61-67)."

The conductive members (34A-Figure 3D) in Farnworth et al. ('731), establish electrical communication between the mating external contacts (38A, 40A-Figure 3F) on the opposing sides of the substrate 10 (column 8, lines 17-19). This type of conductive member is also known in the art as a conductive via. However, in Wakabayashi there are no conductive members, because the electrodes 6 are only on the circuit side of the die. The proposed incentive for

the combination therefore makes no sense. Accordingly, when viewed from the viewpoint of one skilled in the art at the time of the present invention, there would be no incentive for the combination of Farnworth et al. ('731) and Wakabayashi.

As a proposed incentive for combining Kinsman et al. with Wakabayashi the Office Action states: "It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Wakabayashi to include a plurality of terminal contacts on the contact bumps as disclosed in Kinsman because it aids in providing external connections (For Example: See Column 5 Line 10)."

However, this statement distorts the teachings of Kinsman. Put in proper context, the cited passage at column 5, lines 7-10 of Kinsman does not teach that the external conductive elements 32 aid in providing external connections. Rather, the cited passage states that the material of the intermediate conductive elements 20 must be compatible with the material of the external conductive elements 32.

2. Claims "Taken As A Whole" Are Unobvious

The rejections under 35 USC §103(a) are further traversed because the rejected claims "taken as a whole" are unobvious over the art. In particular, the combination of elements recited in the claims is not disclosed or suggested by the art. However, the rejected claims have been amended to include additional limitations which further distinguish the claimed component from the prior art.

Claim 170

Independent claim 170 recites a chip scale component comprising a thinned die, a planarized circuit side polymer layer having edge polymer layers on the edges of the

thinned die, a planarized back side polymer layer, contact bumps on the circuit side, and terminal contacts on the contact bumps.

Claim 170 has been amended to include the limitations of "a planarized back side" of the thinned die, "a planarized first polymer layer" on the circuit side of the thinned die, and "a planarized second polymer layer" on the back side of the thinned die. Antecedent basis for the "planarized" recitation in describing the first polymer layer (circuit side polymer layer 36P-Figure 4C) is contained on page 22, line 23 of the specification. Antecedent basis for the "planarized" recitation in describing the second polymer layer (back side polymer layer 38P-Figure 4C) is contained on page 24, line 33-34 of the specification. Antecedent basis for the "planarized" recitation in describing the backside of the thinned die is contained on page 5, lines 1-3, and on page 23, lines 30-32 of the specification.

In the present claims, the "planarized" recitations are structural limitations rather than "product by process" limitations. As stated in MPEP §2113, and as held in In re Garnero, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979): "terms such as "welded", "intermixed", "ground in place", "press fitted", and "etched" are capable of construction as structural limitations."

In the present component the planarized elements provide an improved component because all the major surfaces of the component have been planarized. In addition, the planarized elements are different than the equivalent prior art elements. In Wakabayashi the seal film 13 on the circuit side of the substrate 1' (die) is polished (column 4, line 5). However, "polished" has a different meaning in the art than "planarized". In addition, there is no suggestion in Wakabayashi of a planarized seal film 17 on the back side of the substrate 1' (die). Further, there is no suggestion in Wakabayashi

of forming the planarized seal film 17 on a planarized back side of a thinned die.

In Kinsman et al. the encapsulant material 30 is planarized on the circuit side of the substrate 10 (column 8, line 44). However, there is no suggestion in Kinsman et al. of the encapsulant material 30 on the back side being planarized, or being applied to a planarized back side of a thinned die.

In Farnworth et al. ('731) the substrate 10 is thinned from the back side, and the conductive members 34A are planarized (column 8, lines 62-65). However, there is no suggestion in Farnworth et al. ('731) of a planarized front side insulating layer 20, or a planarized back side insulating layer 22.

Claim 170 has also been amended to include the limitation of the "edge polymer layers covering and rigidifying the peripheral edges". Antecedent basis for this recitation is contained on page 29, lines 21-23 of the specification. Admittedly, as exemplified by Farnworth et al. ('731), thinned dice are known in the art. However, in the present component the edges of a thinned die are covered and rigidified by edge polymer layers. Admittedly, as exemplified by Wakabayashi, edge polymer layers are also known in the art. However, edge polymer layers which cover and rigidify the edges of a thinned die are submitted to be unobvious over the art.

Claim 170 also includes the recitation of "the first polymer layer and the second polymer layer encapsulating the die on six sides such that the component has a chip scale outline corresponding to the outline of the die plus the edge polymer layers". Although encapsulated chip scale components are known in the art, an encapsulated chip scale component having a thinned die is submitted to be novel and unobvious over the art. In addition, the Examiner is asked to view the claims "as a whole" as a combination of all the above noted features. Thus although some features of the

component are known in the art, the combination of features is submitted to be unobvious over the art.

Claims 171 and 268

Claim 171 has been amended to include the limitation that "the die comprises a tested and burned in die and the component comprises a known good component (KGC)." Antecedent basis for this recitation is contained on page 5, line 23, and on page 7, lines 16-19 of the specification.

Dependent claim 268 contains a similar recitation, which was dismissed as being a "product by process" limitation of no patentable significance. However, this interpretation of these limitations is submitted to be incorrect. "Tested", "burned-in" and "known good component" are descriptive terms which describe physical characteristics of the die and component. In this regard, a tested and burned-in die is physically different than an untested die, because it does not contain defects revealed by testing. Similarly, a known good component denotes a component that has been certified as having no defects. One indicia of the physical difference is that semiconductor manufacturers can charge more money for known good components.

With the present component the unique fabrication process for making the component allows it to be tested and burned in at the wafer level. In particular, the edge polymer layers provide isolation, such that defective components on the wafer remain electrically isolated during burn-in (page 28, lines 20-23 of the specification). However, the completed component has physical characteristics imparted by the fabrication process that make it different and unobvious over prior art components that have not been tested.

As stated in MPEP §2213: "The structure implied by the process steps should be considered when assessing the

patentability of product-by-process claims over the prior art, especially where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product."

Claim 175

Claim 175 has been amended to recite that "the second polymer layer covers planarized edges of the edge polymer layers." Antecedent basis for the "planarized edges" recitation is contained on page 23, lines 30-32 of the specification, which describes planarization of the back side of the die, which also planarizes the edge polymer layers. Antecedent basis is further provided by Figures 1H and 4C, wherein the edge polymer layers 40 are shown as planarized with the back side 22.

Although edge polymer layers are known in the art, the presently claimed "planarized" edge polymer layer provide an improved component, because a planar surface for the second polymer layer (back side polymer layer 38P-Figure 4C) is provided.

Claims 174, 176, 177, 262-264 and 270

Claims 174, 176, 177, 262-264 and 270 are submitted to recite features which in combination with the previous recited features of independent claim 170 make these claims unobvious over the art.

35 USC §103(a) Rejections Of Claims 172, 173 and 264 Over Wakabayashi, Kinsman et al., Farnworth et al. and Farnworth et al.

Claims 172, 173 and 264 are submitted to be unobvious over the art for essentially the same reasons argued above with respect to independent claim 170. In particular, one skilled in the art at the time of the invention would have no incentive to combine the references in the manner of the Office Action. Further, independent claim 170, and thus claims 172, 173 and 264 in combination with claim 170

include limitations which are not disclosed or suggested by the prior art.

35 USC §103(a) Rejection Of Claim 178 Over Wakabayashi, Kinsman et al., Farnworth et al. and Akram et al.

Claim 178 is submitted to be unobvious over the art for essentially the same reasons argued above with respect to independent claim 170. In particular, one skilled in the art at the time of the invention would have no incentive to combine the references in the manner of the Office Action. Further, independent claim 170, and thus claim 178 in combination with claim 170 includes limitations which are not disclosed or suggested by the prior art.

35 USC §103(a) Rejection Of Claims 266 and 267 Over Wakabayashi, Kinsman et al., Farnworth et al. and Hembree et al.

The pin one indicator limitations in claims 266 and 267 have been removed to overcome the objections to the drawings. Amended claims 266 and 267 are submitted to be unobvious over the art for essentially the same reasons argued above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 269 Over Wakabayashi, Kinsman et al., Farnworth et al. and Lin

Dependent claim 269 recites the limitation of the thinned die being "contained on a semiconductor wafer having a polymer support dam proximate to edges thereof".

Lin was cited as disclosing a dam structure 40 (Figure 4). However, in Lin the dam structure 40 is formed on a circuitized substrate 12, rather than on a semiconductor wafer as presently claimed. The dam structure 40 in Lin serves to constrain an encapsulant (abstract), rather than to support edges of a wafer containing thinned dice. Further, the dam structure 40 in Lin does not inherently perform a support function because the dam 40 comprises a

polymer (column 5, lines 7-9), whereas the substrate 12 comprises a reinforced circuit board material such as FR4 (column 3, line 12). Although dams are known in the art, the presently claimed support dam on a wafer containing a thinned die is submitted to be novel and unobvious over the art.

Claim 269 is also submitted to be unobvious over the art for essentially the same reasons argued above with respect to independent claim 170.

35 USC §103(a) Rejection Of Claim 271 Over Wakabayashi, Kinsman et al., Farnworth et al. and Functional And Smart Materials

Dependent claim 271 recites the limitation of "the first polymer layer comprises parylene." The "Functional And Smart Materials" article was cited as teaching parylene for semiconductor devices as providing high reliability.

However, the seal film 13 in Wakabayashi, the encapsulant material 30 in Akram, and the planarized front side insulating layer 20, in Farnworth et al. ('731) already appear to be reliable. The proposed incentive for the combination is therefore not valid. Further, in the present component parylene is used to provide edge polymer layers for a thinned die. It is submitted that the cited art does not suggest the presently claimed use of parylene to achieve an encapsulated chip scale component.

Claim 271 is also submitted to be unobvious over the art for essentially the same reasons argued above with respect to independent claim 170.

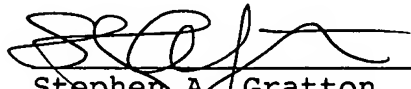
Conclusion

In view of the amendments and arguments, favorable consideration and allowance of claims 170-179 and 262-271 is respectfully requested. An Information Disclosure Statement is being filed concurrently with this Amendment.

Should any issues arise that will advance this case to allowance, the Examiner is asked to contact the undersigned by telephone.

DATED this 11th day of September, 2006.

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